



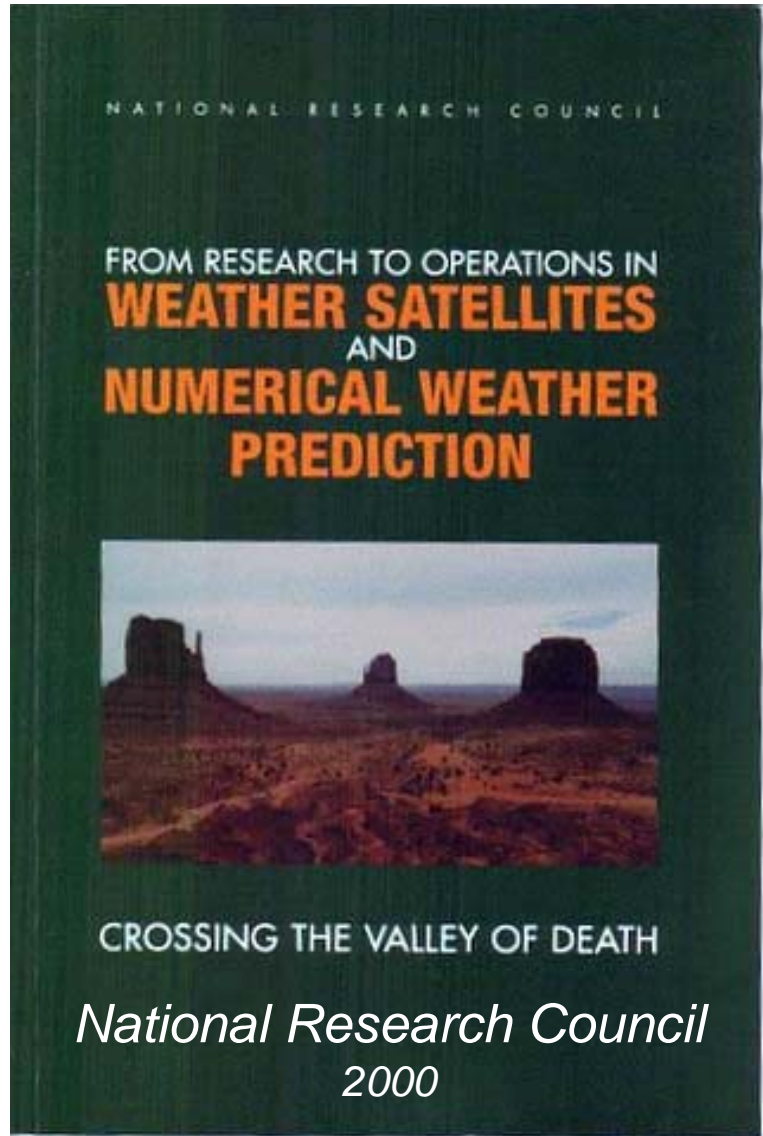
# Bridging the Gap

**Exploring the Barriers and Potential Solutions to  
Cross-jurisdictional Invasive Species Mapping,  
Documentation and Data Management**

Barron J. Orr  
Geospatial Extension Program  
University of Arizona

September 6, 2007

# The technology transfer challenge



“Crossing the Valley of Death”  
is sometimes used in industry to describe the fundamental challenge of transitioning from research to implementation.

# Unsuccessful crossings

**The National Research Council report advises, that, if done improperly, transitions from research to implementation often result in “skeletons in the Valley of Death”**



# Successful crossings

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## □ Require:

- An understanding of the importance (and risks) of the transition
- Development and maintenance of appropriate transition plans
- Adequate resource provision
- Continuous feedback (in both directions) between R&D and operational activities
- Making outreach bidirectional: “*Inreach*”

## □ Recommend that AZ-ISMap employ a user-driven, adaptive R&D approach to help ensure a successful crossing!

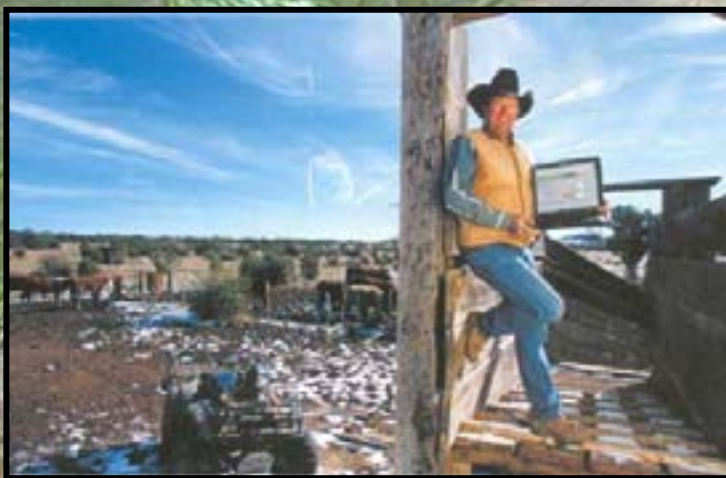




# The Geospatial Extension Program in Arizona




*Bringing people and geospatial technology together*





# A Convergence of User Needs and Agency Missions



 Cooperative State  
Research, Education, and Extension Service





# **The mission of NGTEN is...**

**...to facilitate the practical use of Earth systems science and geospatial technology, and help meet the growing demand for a spatially literate workforce.**

**This is made possible through seeds sown by NASA, USDA and NOAA, and the networks provided by Land Grant (Cooperative Extension), Space Grant, Sea Grant and other local partners.**







## National Geospatial Technology Extension Network

Our mission is to facilitate the practical use of Earth systems science and technology, and help meet the growing demand for a spatially literate workforce. This is made possible through seeds sown by NASA, USDA and NOAA, and the science and education networks provided by Land Grant (Cooperative Extension), Space Grant, Sea Grant and other local partners.



Alabama  
Arizona  
Connecticut  
Mississippi  
Missouri  
Nebraska  
New Hampshire  
North Dakota  
Ohio  
Oklahoma  
Rhode Island  
Texas  
Utah  
Virginia



About  
Geospatial  
Extension



Outcomes  
and  
Impacts



Resources



Geospatial  
Technology



Applications



### From Our Archives



Courtesy of Philip Rasmussen  
Utah State University

### Upcoming Events

**ESRI International User  
Conference 2007**  
August 20-24, 2007

[Website](#) • [More Info](#)

**URISA's 2007 Annual  
Conference**  
August 20-23, 2007  
Washington, DC  
[Website](#) • [More Info](#)

[Full Calendar](#)

Featured Program  
On  
Target

In each participating state, a Geospatial Extension Specialist (GES) acts as a knowledge broker, or the two-way conduit between research, applications development and practice. We build on existing Earth science capabilities, which include Earth observations from space, modeling and systems engineering, geographic information systems (GIS), the global positioning system (GPS) and spatial decision support systems (SDSS).

Factoid

NASA Learning Technologies: World Wind lets you zoom in from satellite altitude into any place on Earth.



# Business strategy:

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- ❑ Develop a cross-jurisdictional, interactive database and mapping system for invasive species in support of all levels of end-users interested in invasive species: “Arizona Invasive Species Map”.
- ❑ This business strategy requires organizational and infrastructure (in this case, IT) strategies working together to address AZ-ISMap objectives.



# Organizational strategy

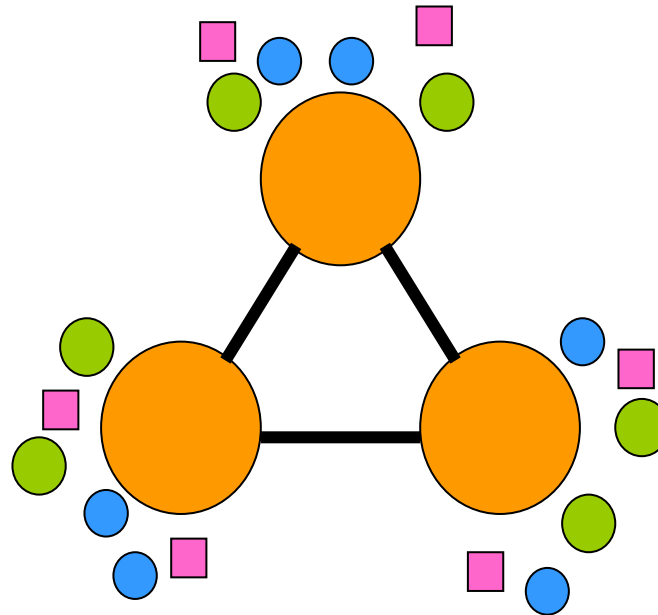
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- *Facilitate collaboration across Arizona's invasive species community to stimulate more effective data/information sharing/use*
  - Existing providers & services
  - End-user functional needs/experience
  - Reach new users
  - Wide range of needs (e.g. those with legacy systems as well as those needing assistance in hosting data)
  - Foster further development of location-based web services by partner organizations and the user community

# Organizational strategy: structure

- A network of organizations with brokers, coordinated by an umbrella entity

- Key organizations (contributing developers and brokers)
- Member organizations with legacy data provision systems
- Member organizations who need assistance in hosting data
- Member organizations with applications that use data





# Information strategy

---

- *Provide accessible, interoperable invasive species data and service infrastructure.*
  - Provides reference/framework data and contextual data drawn from other domain systems
  - Leverages modular, reusable code from existing systems and encourages co-development and interoperability with other state-wide and regional services
  - Capable of “feeding” regional and national applications
  - Flexible enough to address barriers or constraints of participating organizations.
  - Anticipates future needs:
    - risk analysis, gap analysis and prioritization
    - life form (i.e., plants, animals, insects, diseases);
    - research and forecasting (conduit to third-party modeling and simulation tools)

# Information strategy

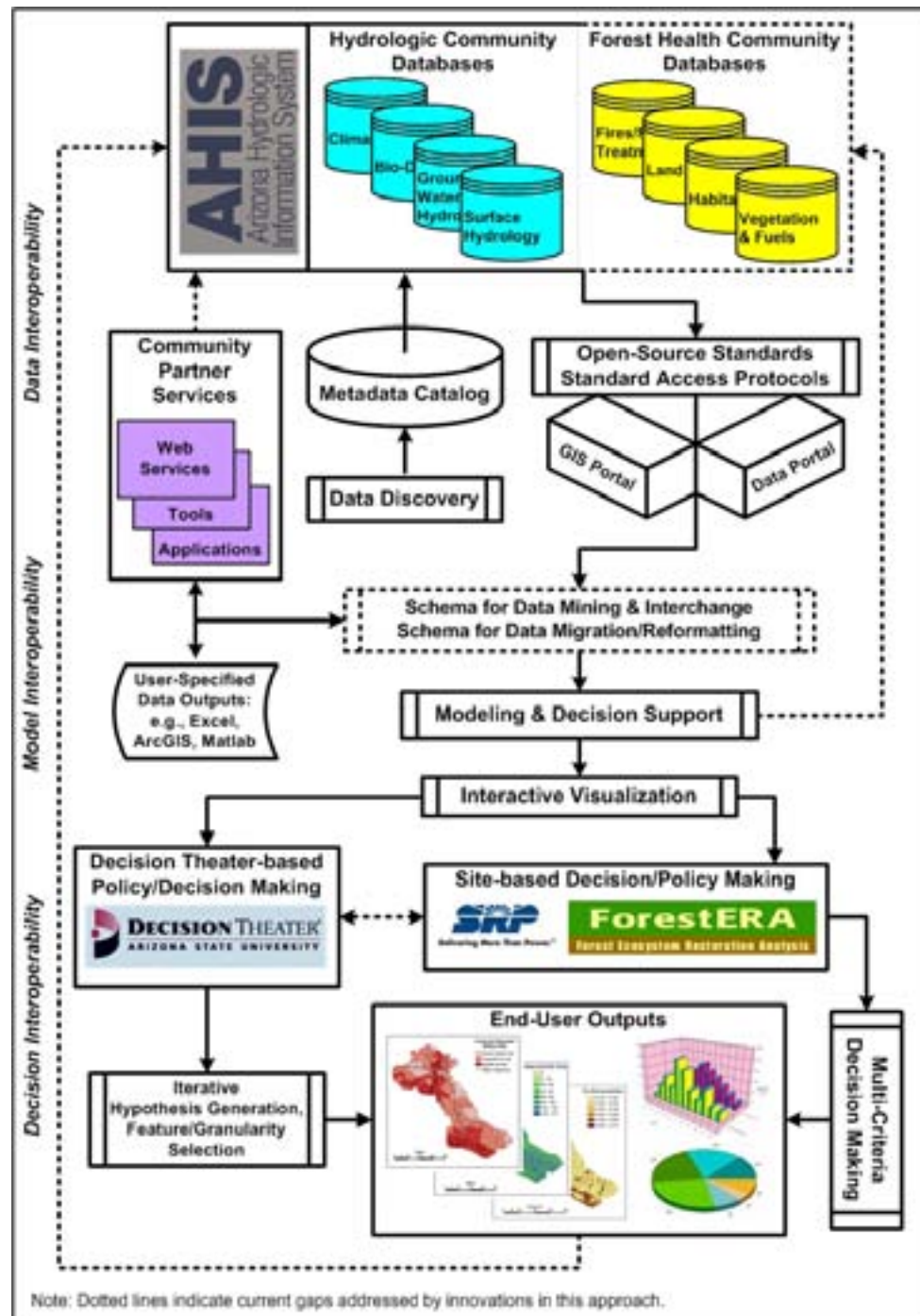
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- *Develop a common database reflecting core standards*
  - Build the network which links/integrates related organizations
    - Support dynamic data and metadata communication between organizations
  - Develop the database schema based on user specifications
    - Primary and secondary attributes
    - Common (across member organizations) and unique attributes
  - Assess the functions required by users
  - Assess the reporting needs of users and decision makers
- Note: this phase is significant, runs in parallel with the protocol and policy phase of the organizational strategy, and is almost always underestimated in terms of time and cost

# Information & Organizational Strategies:

## Pursuing Interoperability:

Combining the strengths of Arizona Water Institute (which is guiding a multi-organization effort to build the Arizona Hydrologic Information System (AHIS) and the Forest Health Council (which guided the development of an cross-organization fuels treatments Database called Arizona FIREMAP.





# Maintenance and sustainability

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Need to develop business models for:

## □ AZ-ISMap

- core hardware, software, data, personnel, and services.
- Technical approach to system maintenance and upgrades that corresponds to the sustainability plan of the network

## □ Member organizations

- Data standards, data and metadata standards
- QA/QC rating system
- Security, privacy, and other data restrictions

## □ Usability

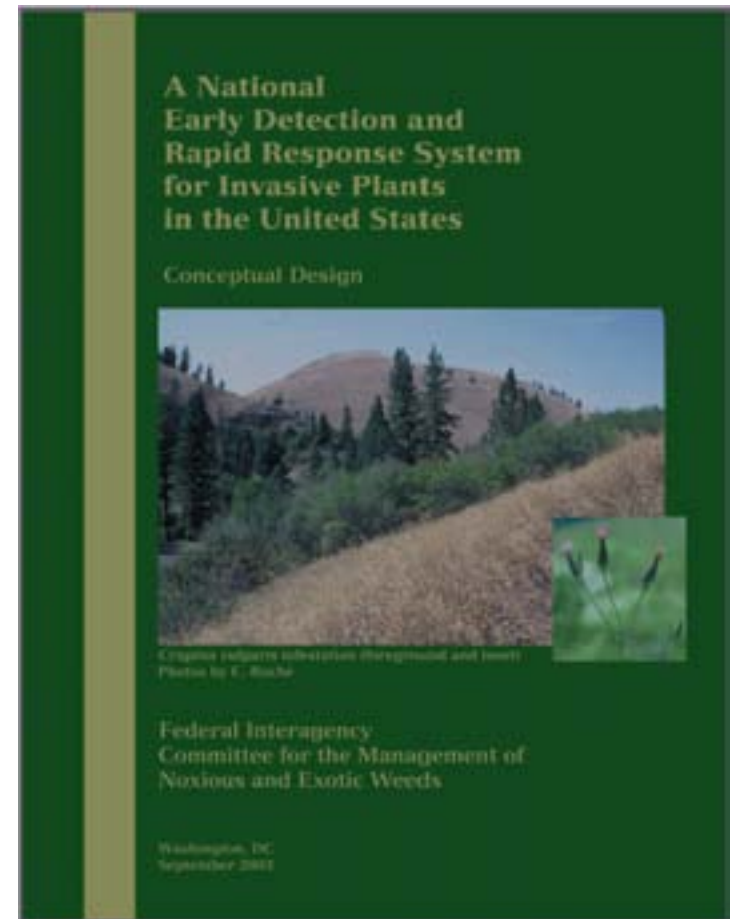
- Development based on a user-driven approach (intensive, iterative user-oriented specification and usability assessment)

## □ Technology transfer

- For example, leverage the Geospatial Extension Program and other potential partners (e.g. AGIC)

# What's right (and wrong) about this picture?

*On behalf of the 16-member Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW), we are sincerely grateful to the many public and private contributors to the elements of this project since its beginning in 1998. The need for a national system to detect, assess, and respond to invasive species infestations in their early stages of establishment has energized FICMNEW to develop this conceptual design for such a system for invasive plants. With the rapidly growing threat from all invasive species, we are confident that this conceptual design can be a useful building-block for the eventual establishment of a broader early detection and rapid response system for all invasive species in the United States.*



# Problem

---

- ❑ Limited coordination limits access
  - Invasive species observations, effort tracking and the mapping of treatments are essential.
  - Data integration/sharing across organizations.
  - Excellent regional database (SWEMP), but not designed to address local coordination challenges.
  - **No coordinated method to capture/integrate/access/analyze/report** invasive species occurrences and treatments in Arizona that can address state-wide reporting needs while supporting local coordination needs.
- ❑ Limited interoperability limits effective use
  - Variability in data completeness
  - NO automated pipeline



# Pieces of the puzzle (as seen from above)?

The image displays two overlapping web browser screenshots. The left screenshot shows the National Institute of Invasive Species Science (NISS) website. It features a search form for species information, a navigation menu on the left, and a sidebar with links to various resources. The right screenshot shows the Global Invasive Species Initiative (GISI) website, specifically the WIMS (Weed Information Management System) overview page. This page includes a detailed description of WIMS, its benefits, and a list of resources for users.

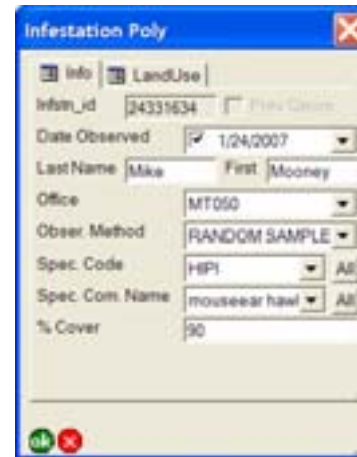
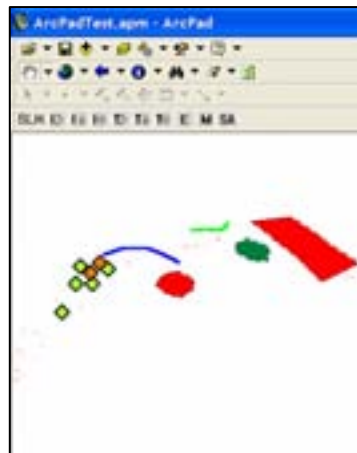
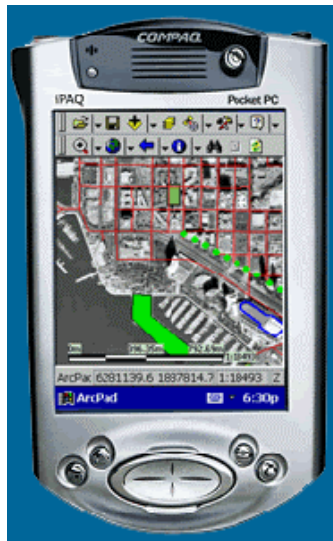
**NISS Website (Left Screenshot):**

- Search Form:** Fields for Scientific Name, Common Name, and NISS Code. Buttons for "Reset" and "Submit".
- Navigation Menu:** Home, About Us, Gather Data, Field Methods, Field Tools, Browse Data, Contribute Data, Analyze Data, Download Data.
- Species Info:** Interested in a specific species? We are collecting data on key invasive species. Type a species.
- In Your Area:** Select an area of interest, Query our database, View our map.

**GISI Website (Right Screenshot):**

- Header:** The Global Invasive Species Initiative, The Nature Conservancy.
- Section:** WIMS: A More Detailed Look.
- What is WIMS and what does it do?** WIMS is a Microsoft Access-based relational database application. It was initially designed to assist natural resource managers keep track of their own weed data, but WIMS can also be used to compile and share weed data between multiple users. Additionally, WIMS can be used on a handheld unit with a GPS unit to facilitate weed mapping and data capture in the field.
- What WIMS does:** keep track of weed occurrences, assessments (monitoring over time), and any management treatments applied. Once data have been entered into the Access database (either manually or from a handheld unit), data can be:
  - Easily exchanged between multiple users.
  - Exported to NAWMA standards in an Excel spreadsheet.
  - Written to GIS shapfiles to produce maps.
  - Summarized in a variety of reports.
- WIMS Overview Document:** A 2-page informational handout on WIMS. [Download PDF \(3.6 KB\)](#)
- WIMS Powerpoint Presentation:** After viewing this presentation, you should know whether WIMS is suitable for your project! [PowerPoint \(11.4 KB\)](#) Download to share WIMS to other folks
- Why Should I Use WIMS?** We do not expect everyone to use WIMS. But we do encourage everyone to manage their weed data so they can make informed on-the-ground management decisions. By keeping good records, staff can keep track of all weed infestations, prioritize management activities, know which management treatments work and which do not work, and share data with partners. Regardless of whether you decide to use WIMS, you should keep track of your weed data using NAWMA (North American Weed Management Association, [www.nawma.org](http://www.nawma.org)) standards.
- Benefits of Using WIMS (or any other weed relational database application)** WIMS helps organize and track your weed data, allowing you to efficiently review and report on your weed mapping efforts, the size and extent of weed infestations, and the management treatments you have applied. The ultimate benefit of a relational database (especially one that stores spatial information) is the leverage you gain in prioritizing weed mapping and management efforts. The ability to export data in other Excel or shapfile format also makes it easy to share data with others.
- If you answer "yes" to any of the following questions, using WIMS (or another similar weed database application) can definitely benefit your management efforts?**
  - Do you struggle to keep track of all of your weeds and weed infestations?
  - Do you have trouble remembering exactly what you did last year to a specific weed infestation? Three years ago?
  - Are you unsure exactly how much time you and your volunteers spent pulling that Weed XYZ last year?
  - Did you figure how much herbicide you used last year?
  - Are you unsure of which weeds are on a given management unit?
  - Are you unsure of the distributions of the weeds on a given management unit?
  - Are you unsure which weeds (or infestations) you should start controlling?
  - If you leave your position... will you have trouble sharing your replacement where all of your weeds are, and their management history?

# Pieces of the puzzle (as seen w/in one organization)



Selected screen shots from the BLM Invasive Species Management Information System (courtesy of Kathie Jewell)

# Pieces of the puzzle (as seen from the ground)



## Invaders of the Sonoran Desert Region Plant Data Sheet



Recorder's Name: Marilyn Hansen

Date: 02/05/06 Time: 10:20 am  
(month/day/year) (00:00 24hr)

Site Name: South side of Brown Mt

Site Number: 2

Slope: F G M S C Aspect: S Elevation 867 m

Dist to Water: 1 m Dist to Road: 100 m

Weather Conditions Sunny, clear

Vegetation types	
<input type="checkbox"/>	Chihuahuan Desert
<input type="checkbox"/>	Mohave Desert
<input checked="" type="checkbox"/>	Arizona Upland Sonoran Desert
<input type="checkbox"/>	Lower Colorado Valley Sonoran Desert
<input type="checkbox"/>	Chaparral
<input type="checkbox"/>	Coniferous Forest
<input type="checkbox"/>	Oak woodland
<input type="checkbox"/>	Oak-pine woodland
<input type="checkbox"/>	Grassland
Water/Riparian Types	
<input type="checkbox"/>	Riparian - marsh/cassia/cienega
<input type="checkbox"/>	Riparian - Lake/reservoir
<input type="checkbox"/>	Riparian - temporary water
<input type="checkbox"/>	Riparian - stream/river
<input type="checkbox"/>	Riparian - spring
<input checked="" type="checkbox"/>	N/A

Landform	
<input type="checkbox"/>	Ridgetop or mesa
<input checked="" type="checkbox"/>	Rocky slope
<input type="checkbox"/>	Rocky slope with cliff
<input type="checkbox"/>	Rocky slope with talus
<input type="checkbox"/>	Canyon (in mountains)
<input type="checkbox"/>	Upper bajada
<input type="checkbox"/>	Lower bajada
<input type="checkbox"/>	Valley floor - rocky or gravelly
<input type="checkbox"/>	Valley floor - silty or sandy
<input type="checkbox"/>	Valley floor - floodplain
<input type="checkbox"/>	Wash - shallow or no banks
<input type="checkbox"/>	Wash - deep/deep banks
<input type="checkbox"/>	Sand dunes (or flats)

Disturbance	
<input type="checkbox"/>	Recent Fire
<input type="checkbox"/>	Flood
<input type="checkbox"/>	Cleared
<input type="checkbox"/>	Urbanized
<input type="checkbox"/>	Roadside
<input type="checkbox"/>	Other (describe in site notes)
<input type="checkbox"/>	None

Site Notes:  
Dottie Eakin

Site DB #:

## Species Observation

Species		A		B	
Patch type	point size/shape:	point size/shape:	point size/shape:	point size/shape:	point size/shape:
	line width:	line width:	line width:	line width:	line width:
	polygon shape:	polygon shape:	polygon shape:	polygon shape:	polygon shape:
Location 1	Lat <u>32.14</u> <u>11.3</u> Long <u>111.09</u> <u>53.4</u>	Lat	Long	Lat	Long
Location 2	Lat <u>32.14</u> <u>11.3</u> Long <u>111.09</u> <u>51.3</u>	Lat	Long	Lat	Long
Location 3	Lat <u>32.14</u> <u>11.1</u> Long <u>111.09</u> <u>50.5</u>	Lat	Long	Lat	Long
Location 4	Lat <u>32.14</u> <u>11.1</u> Long <u>111.09</u> <u>50.0</u>	Lat	Long	Lat	Long
Location 5	Lat <u>32.14</u> <u>11.0</u> Long <u>111.09</u> <u>51.3</u>	Lat	Long	Lat	Long
Location 6	Lat <u>32.14</u> <u>11.0</u> Long <u>111.09</u> <u>52.8</u>	Lat	Long	Lat	Long
Extent**	I L E O	I L E O	I L E O	I L E O	I L E O
Percent cover***	<1 1-5 6-25 26-50 51-75 76-95 96-100 SP	<1 1-5 6-25 26-50 51-75 76-95 96-100 SP	<1 1-5 6-25 26-50 51-75 76-95 96-100 SP	<1 1-5 6-25 26-50 51-75 76-95 96-100 SP	<1 1-5 6-25 26-50 51-75 76-95 96-100 SP
Obs type****	C S	C S	C S	C S	C S
Extends into natural habitat	Y N	Y N	Y N	Y N	Y N
Notes:					
Describe patch and abundance	<u>32.14 11.3 111.09 54.9</u>				
Obs ID #					

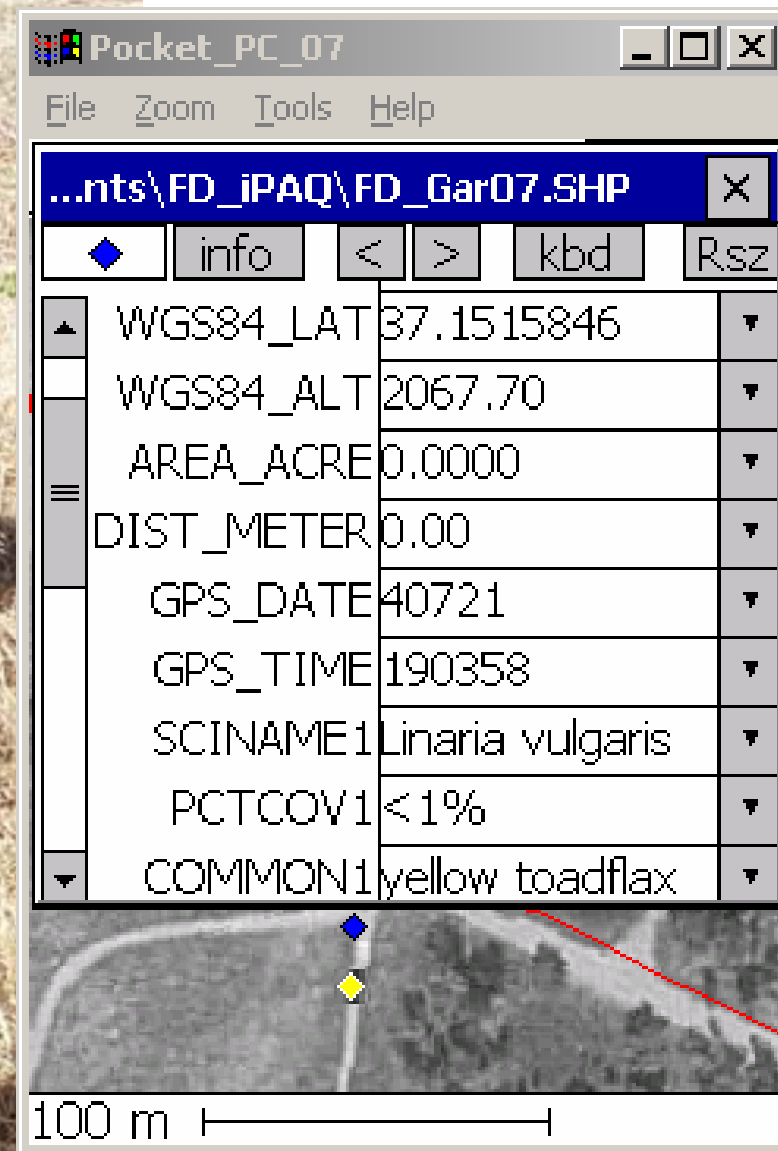
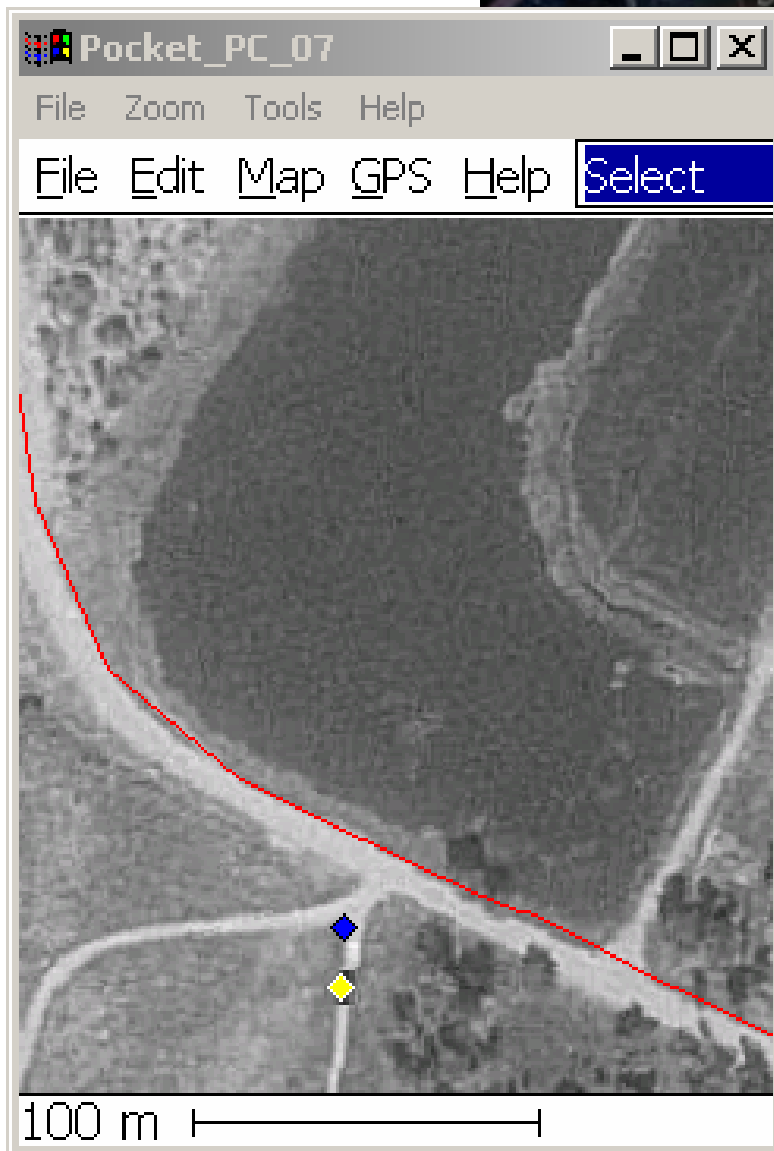






# Making

# Maps



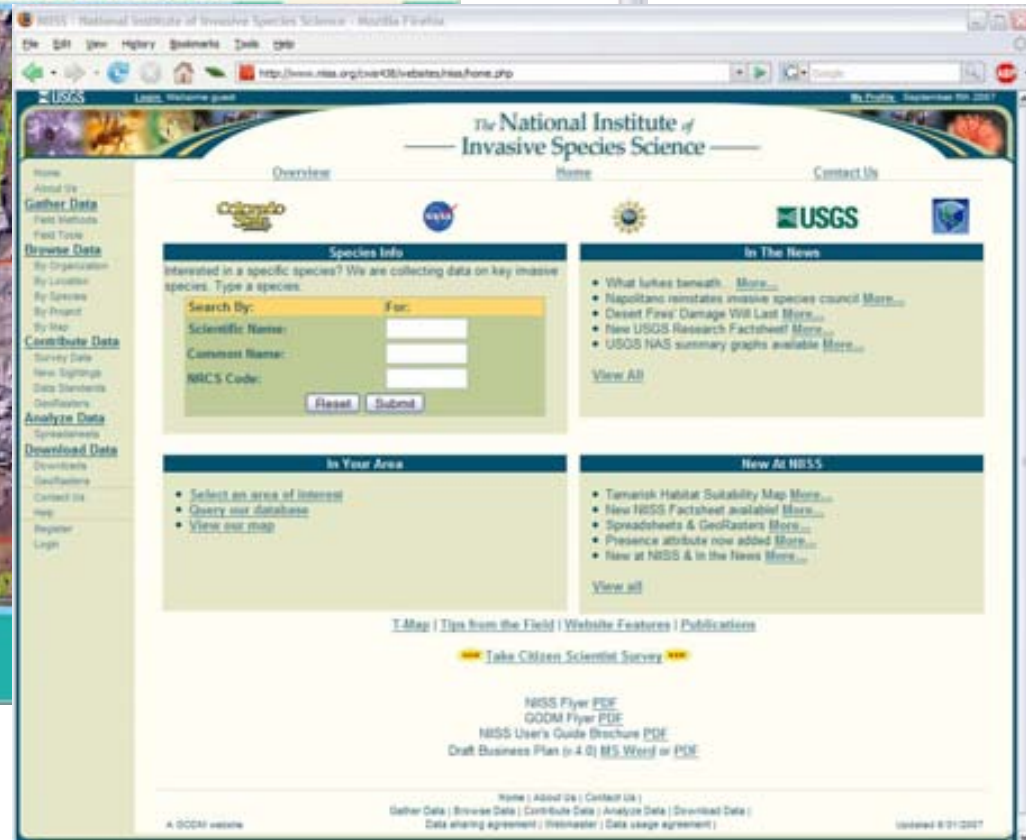
# To Removal:

## The Weedwackers Example

Photo: Marilyn Hanson



# From local to regional/national and back!



# The Data Pipeline



State Agencies  
Tribes  
NGO's  
Federal Agencies  
County Agencies  
Interested Public  
City governments



**Local or  
Regional  
Databases**  
e.g. SWEMP  
AZ-ISMap



**CWMA**



Forest Service NISIMS  
BLM NISIMS ???  
NISIMS ???



NISIMS ???

**Local**



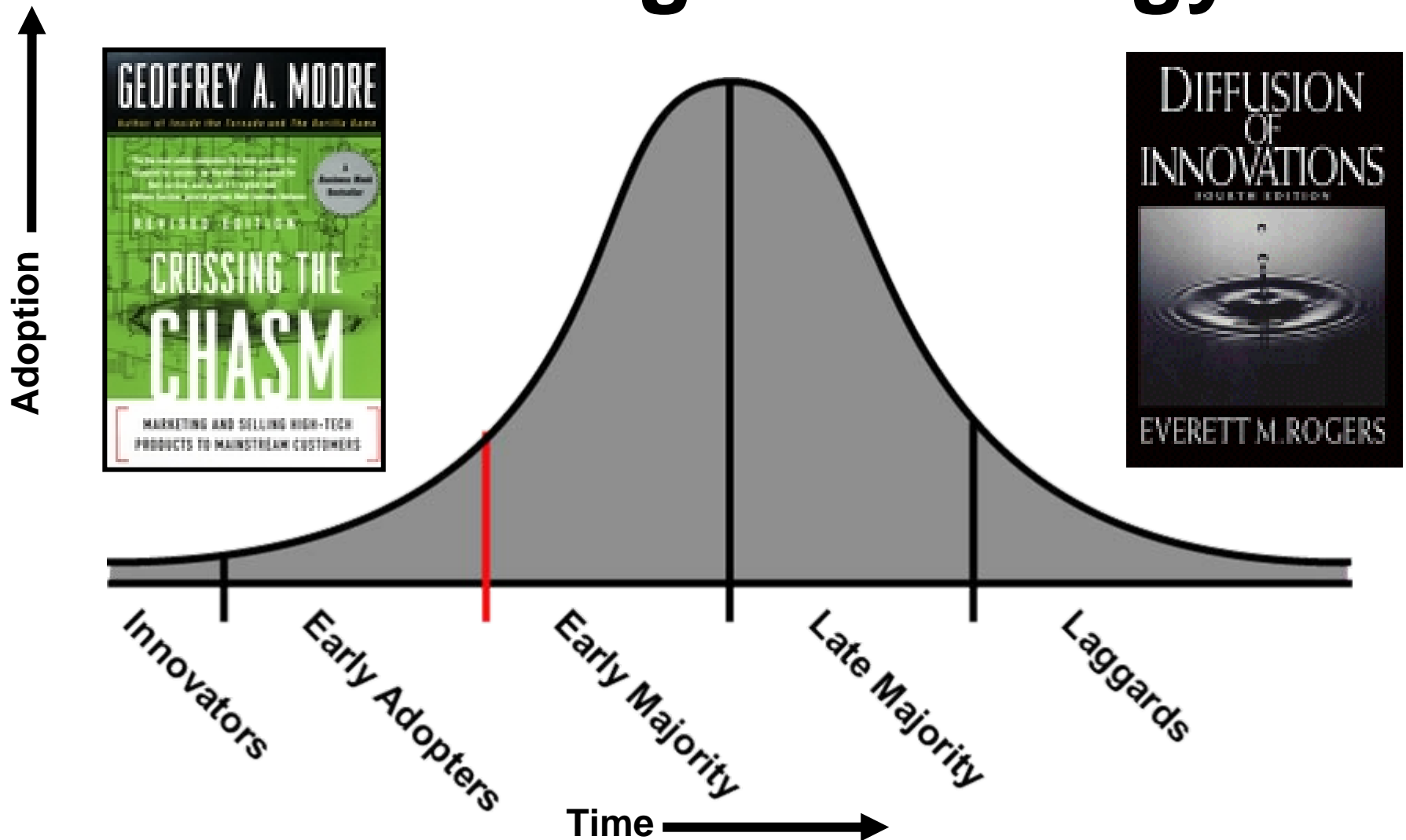
**Regional**



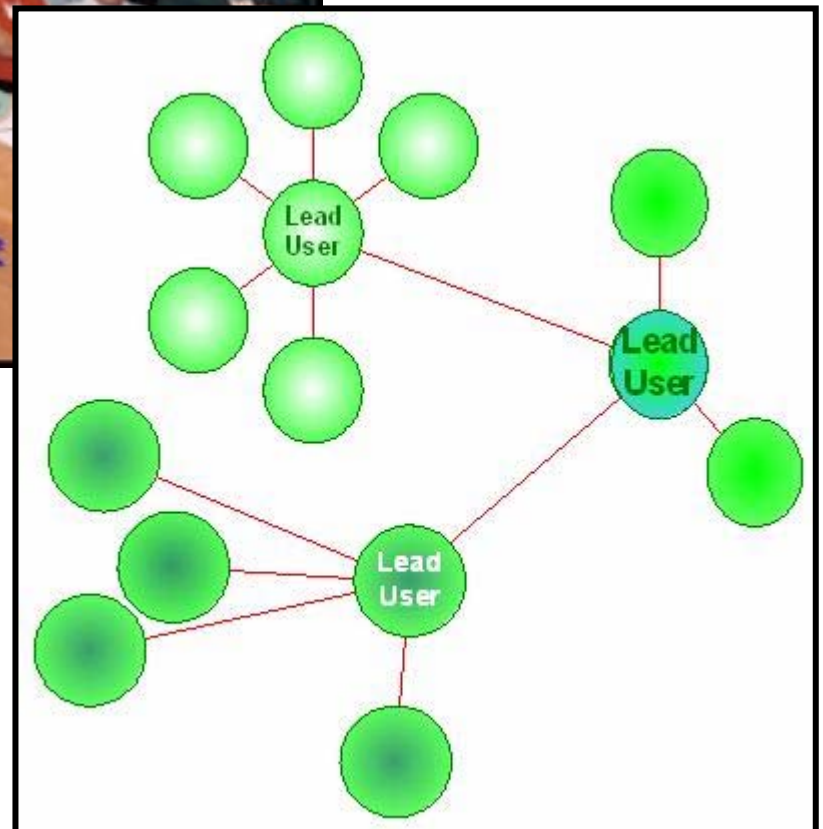
**National**



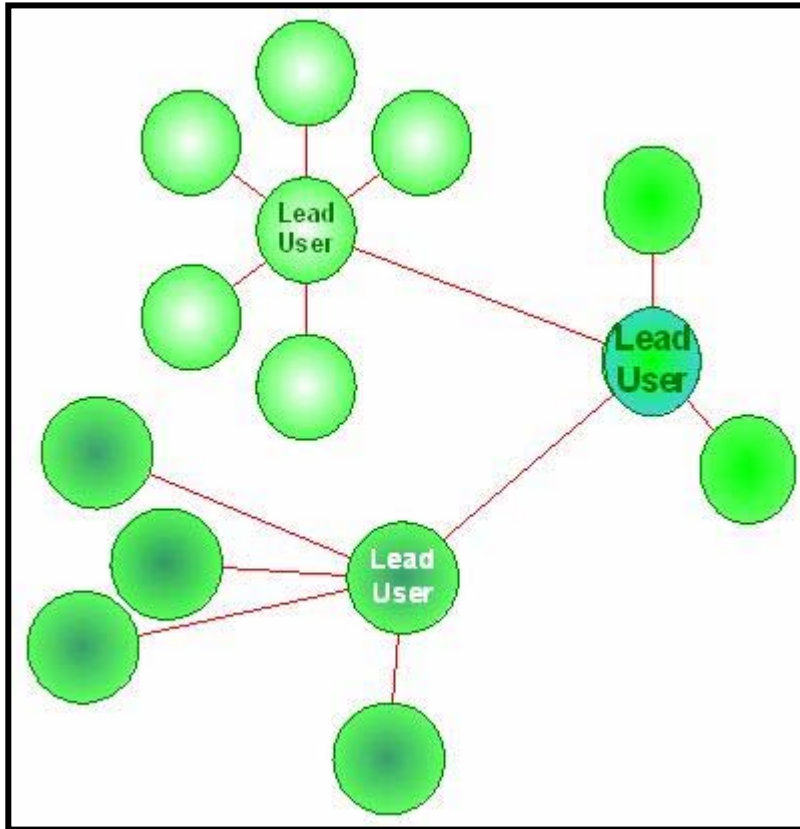
# Translating Science and Transferring Technology



# Diffusion: “Early Adopters” Influence Others



# Diffusion: “Early Adopters” Influence Others



# Two-way Knowledge Exchange: Outreach and *Inreach*



Enhanced decision support: Using MODIS & AVHRR for Ecological Forecasting  
(RangeView October 2002 Workshop)

# Integrating technologies for practical use

## Geospatial Tool Kit

- ❑ Aerial photos/topos in background
  - TerraServer-USA.com
- ❑ GPS Receiver
  - Garmin GPSmap 60
- ❑ Handheld Computer
  - Hp iPAQ series PocketPC
- ❑ GIS on the handheld
  - StarPal HGIS, ESRI ArcPad
- ❑ GIS on the desktop or laptop
  - HGIS and ESRI ArcView





# Equipment Options



# Recent GPS/GIS integrated solutions

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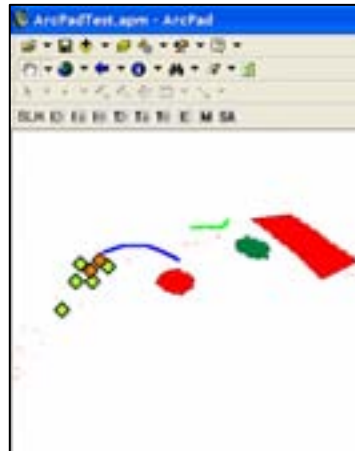
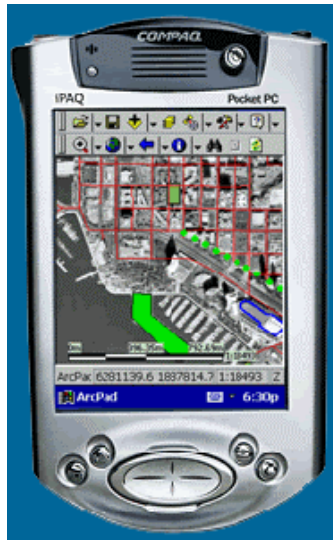
**Trimble Juno ST**



**HP iPAQ rx5915  
Travel Companion**

Both these units combine a Handheld Computer and a Integrated SiRFstarIII GPS receiver – the best integrated options we are aware of. You can add HGIS or ArcPad to each of these. The Juno ST sells for \$650 and the iPAQ for \$600 (\$410 even!).

# Software/Database Options



- ❑ What is the best system? The one you use!
  - The one most commonly used by your agency
  - The one that gets the job done

Selected screen shots from the BLM Invasive Species Management Information System (courtesy of Kathie Jewell)





# The Future Is Now



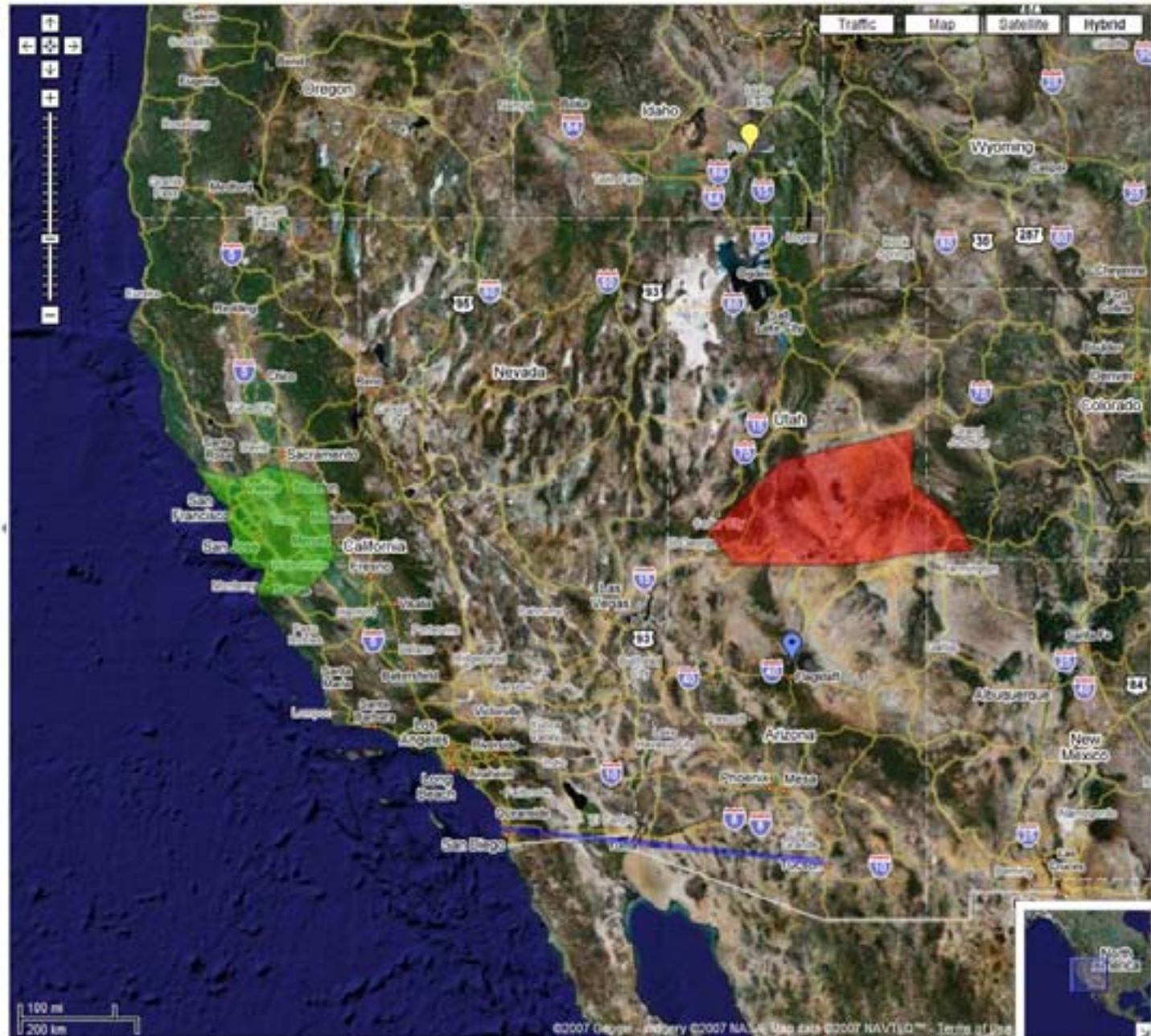
amAze - is for the Java-enabled mobile phone, which can provide and voice guidance to any destination; search or define any location by its address; search and navigate to businesses listed in yellow pages directories.



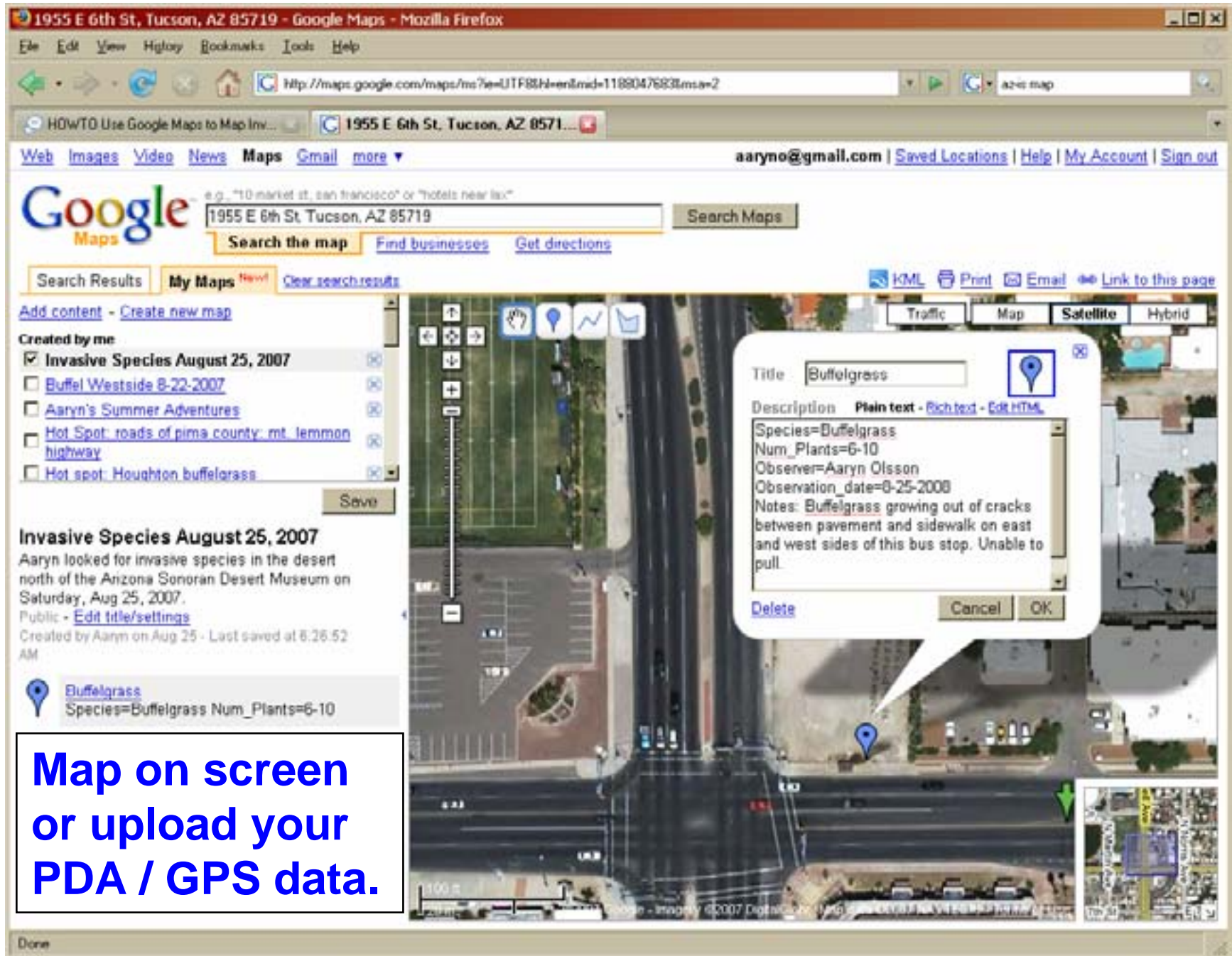
<http://www.maps-gps-info.com/fgpfw.html>











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« Expand

 **PSCB CISMA Mapping and Data Management**  
146 web views  
last week

 **CBG Floral Report Card - manage**  
no activity in the last week

[Manage my memberships](#)  
[Add My Groups to your Google homepage](#)

**My profile & stats**

 Barron Orr

Your 7-day activity  
None

[View your full profile](#)

**Google Groups:**  
An easy way for individuals  
and organizations to share  
information.



PSCB CISMA Mapping and Data Management | Google Groups - Mozilla Firefox

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http://groups.google.com/group/pscb-cisma-mdm

Google Groups barron.orr@gmail.com | My Groups | Favorites | Profile | Help | My Account | Sign out

## PSCB CISMA Mapping and Data Management

Search this group Search Groups

Home New since last time 8 messages

Welcome to the PSCB CISMA Mapping and Data Management Group. This is the place to discuss mapping and data management issues related to invasive species in southern Arizona.

**Discussions** 6 of 10 messages view all » + new post

[Mapping and Data Management Meeting CANCELED](#)  
By Aaryn Olsson - Aug 8 - 1 author - 1 reply  
[View this page "Invasive Species Mapping Standards, Recommendations, a](#)  
By Aaryn Olsson - Jul 15 - 1 author - 0 replies  
[View this page "Mapping Hardware/Software Recommendations"](#)  
By Aaryn Olsson - Jul 11 - 1 author - 0 replies  
[Oregon citizen weed mapping website](#)  
By sarah\_st...@nps.gov - Jul 5 - 1 author - 0 replies  
[Discussion on meeting-notes-june-28-2007](#)  
By cmcint...@sonoran.org - Jul 5 - 2 authors - 1 reply  
[DRAFT: "HOWTO Use Google Maps to Map Invasive Species"](#)  
By Aaryn Olsson - Jul 3 - 1 author - 0 replies

**Pages** 3 of 10 pages view all » + add page

[Invasive Species Mapping Standards, Recommendations, and Resources](#)  
Last updated by Aaryn Olsson - Jul 14 - 1 author - 2 pages long  
[HOWTO Collect Invasive Species Data using HGIS \(stub\)](#)  
Last updated by Aaryn Olsson - Jul 11 - 1 author - 1 page long  
[HOWTO Collect Invasive Species Data using ArcPad \(stub\)](#)  
Last updated by Aaryn Olsson - Jul 15 - 1 author - 1 page long

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Last updated by Aaryn Olsson - Jul 15

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**Group info**

Members: 24  
Activity: Low activity  
Language: English  
Group categories:  
[Science and Technology](#)  
    > [Agriculture](#)  
    [Science and Technology](#)  
    > [Environment](#)  
Region: [United States](#) > [Arizona](#)  
[More group info »](#)

Pima-Santa Cruz Basin Cooperative Invasive Species Management Area's "Group"



Picasa Web Albums - Aaryn - Buffelgrass S... - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://picasaweb.google.com/aaryn/BuffelgrassSabinoMountainandQuailRidge

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New Features! | Help | Sign In | Sign up for Picasa Web Albums

Picasa™ Web Albums

Aaryn's Public Gallery » Buffelgrass Sabino Mountain and Quail...

Community Photos Search Photos

Slideshow View Map Order Prints

Size: [icon] [icon] [icon]

Buffelgrass Sabino Mountain and Quail Ridge  
Tucson, AZ  
Photos: 124 - 50 MB  
Apr 1, 2007  
Public

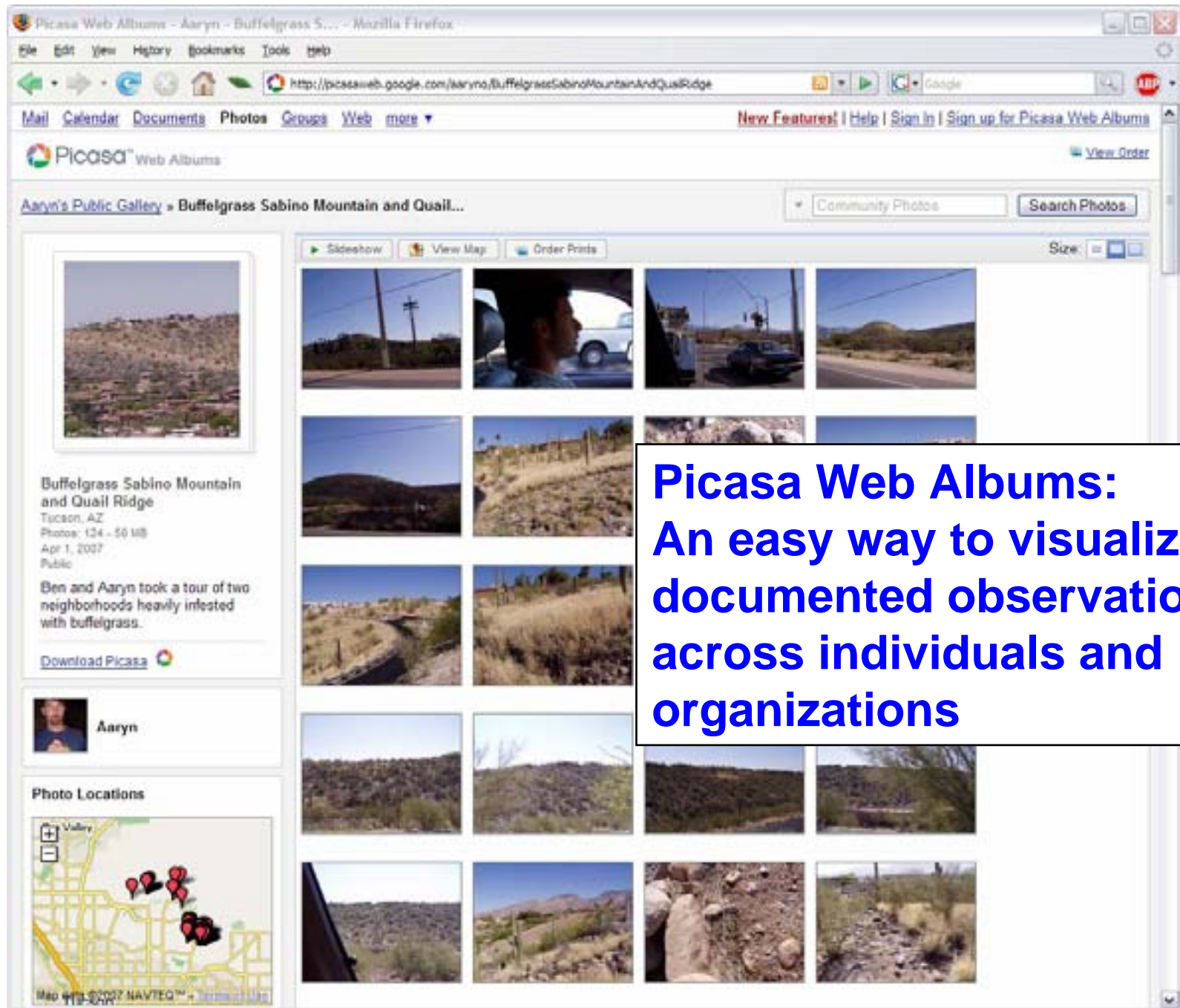
Ben and Aaryn took a tour of two neighborhoods heavily infested with buffelgrass.

Download Picasa

Aaryn

Photo Locations

Map © 2007 NAVTEQ



**Picasa Web Albums:**  
An easy way to visualize  
documented observations  
across individuals and  
organizations

Picasa Web Albums - Aaryn - Buffelgrass 5... - Mozilla Firefox

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http://picasaweb.google.com/aaryno/BuffelgrassSabinoMountainAndQuailRidge/photo#map

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New Features! | Help | Sign In | Sign up for Picasa Web Albums

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View Order

Aaryn's Public Gallery » Buffelgrass Sabino Mountain and Quail

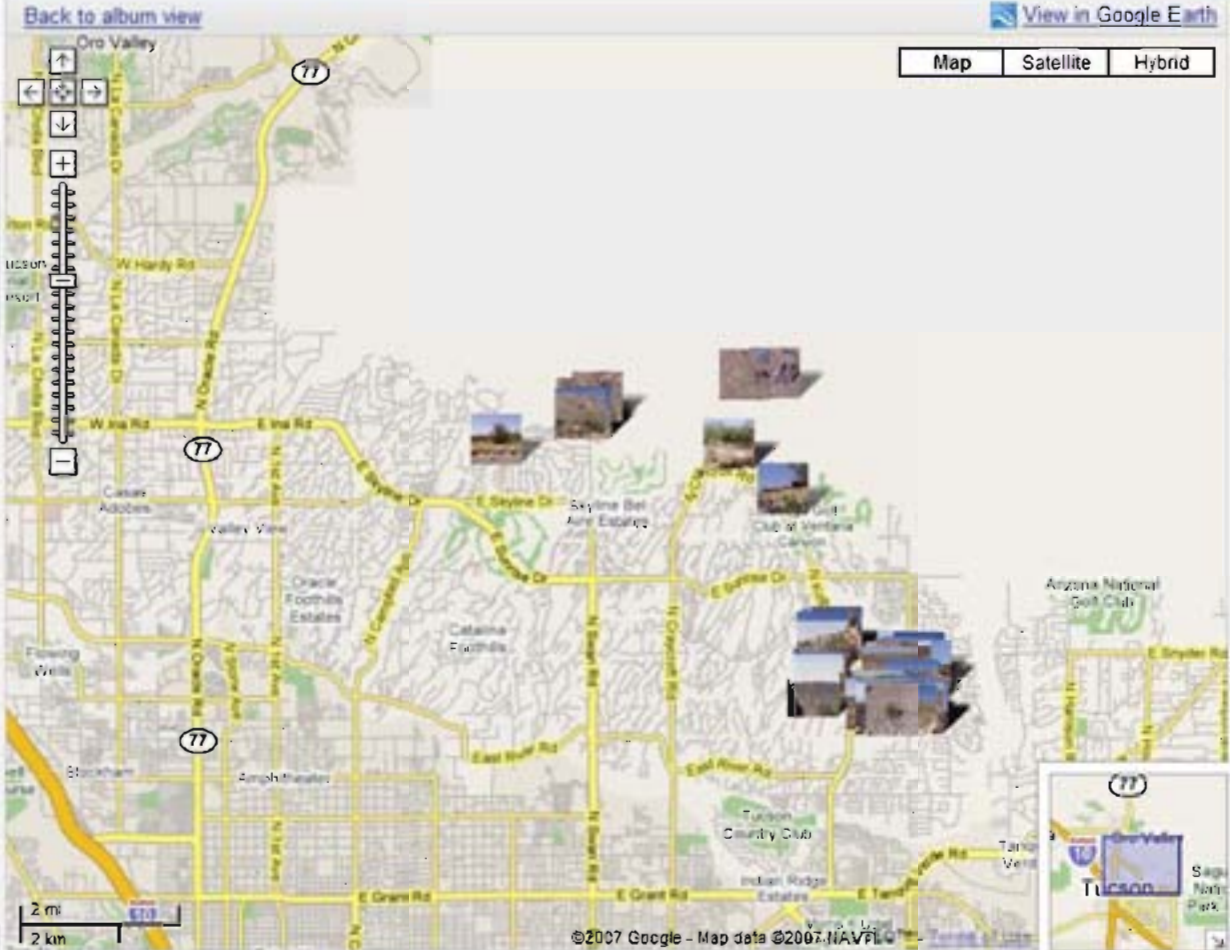

Community Photos Search Photos

View in Google Earth

Map Satellite Hybrid

Back to album view

Buffelgrass...  
By Aaryn  
Tucson, AZ  
Apr 1, 2007 - Public



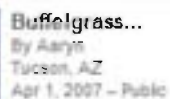
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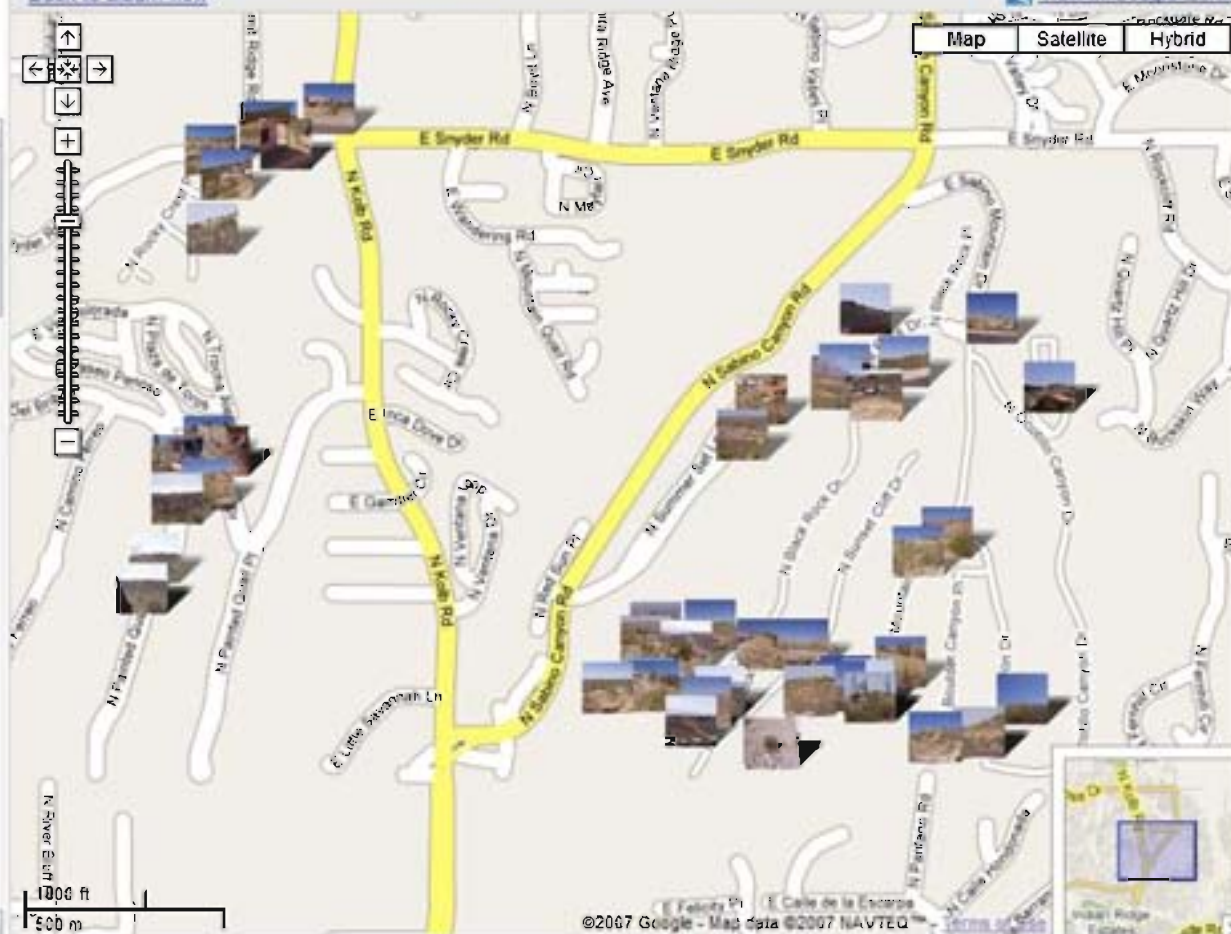


## Community Photos

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Map	Satellite	Hybrid
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Buffelgrass...  
By Aaryn  
Tucson, AZ  
Apr 1, 2007 - Public



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View in Google Earth

Map

Satellite

Hybrid



play

Photo 62 of 89



Dense buffelgrass makes continuous fuel from valley to ridge

P1010074.JPG

32.284883° N 110.823469° W

View full size

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**Google Earth:**  
Brings more sophisticated  
visualization, access to an  
even wider variety of  
datasets.

0.0 25.40225, -125.50152

### Places

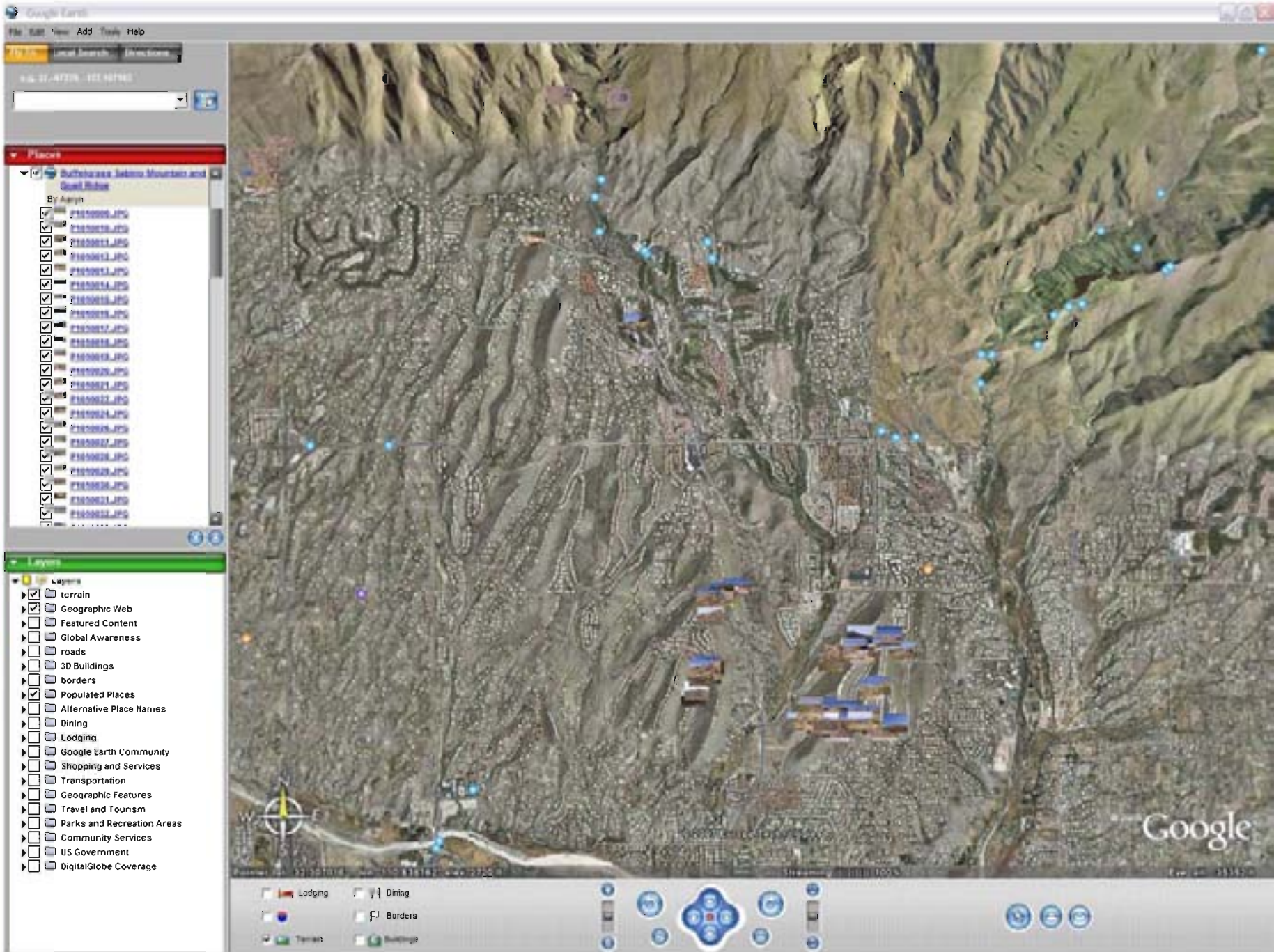
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### Layers

- ▼ Layers
  - ☒ terrain
  - ☒ Geographic Web
  - ☐ Featured Content
  - ☐ Global Awareness
  - ☐ roads
  - ☐ 3D Buildings
  - ☐ borders
  - ☒ Populated Places
  - ☐ Alternative Place Names
  - ☐ Dining
  - ☐ Lodging
  - ☐ Google Earth Community
  - ☐ Shopping and Services
  - ☐ Transportation
  - ☐ Geographic Features
  - ☐ Travel and Tourism
  - ☐ Parks and Recreation Areas
  - ☐ Community Services
  - ☐ US Government
  - ☐ DigitalGlobe Coverage

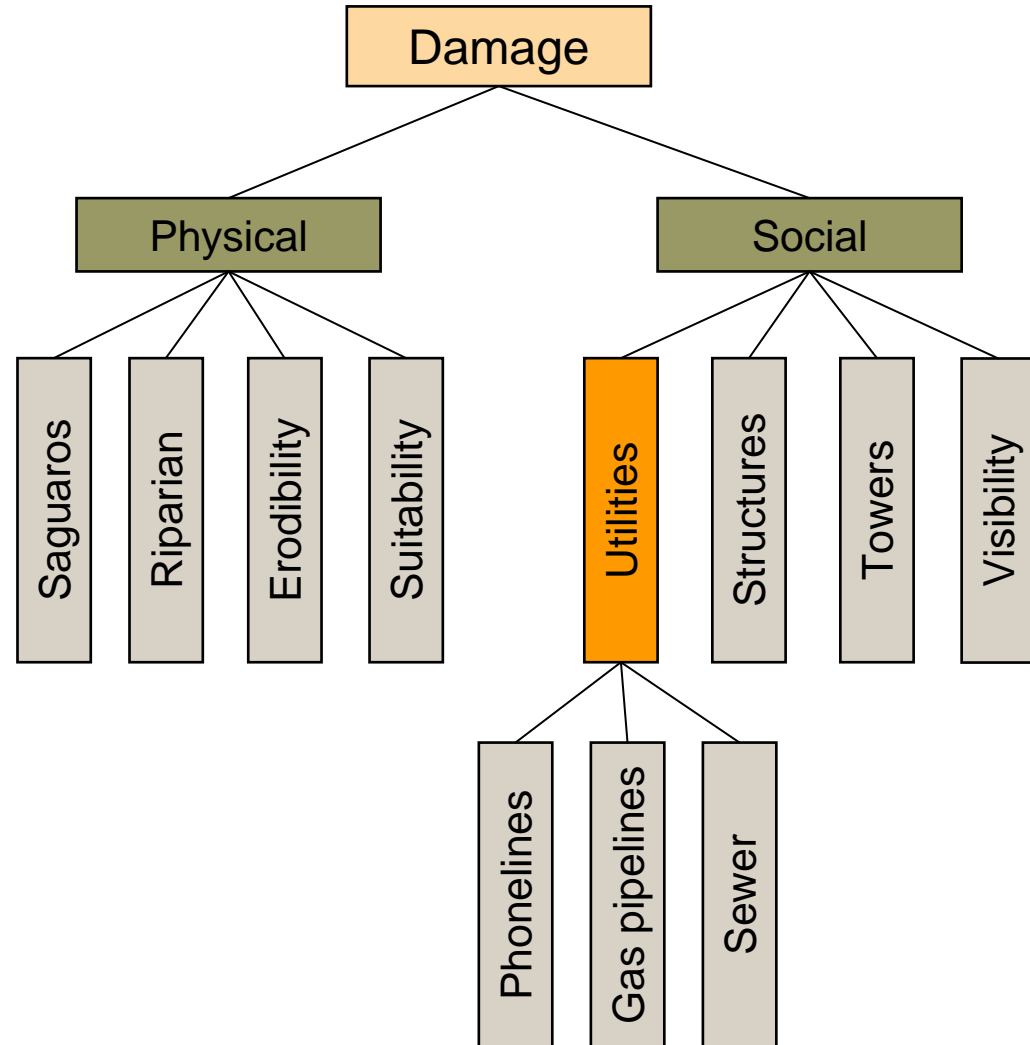






# Decision support

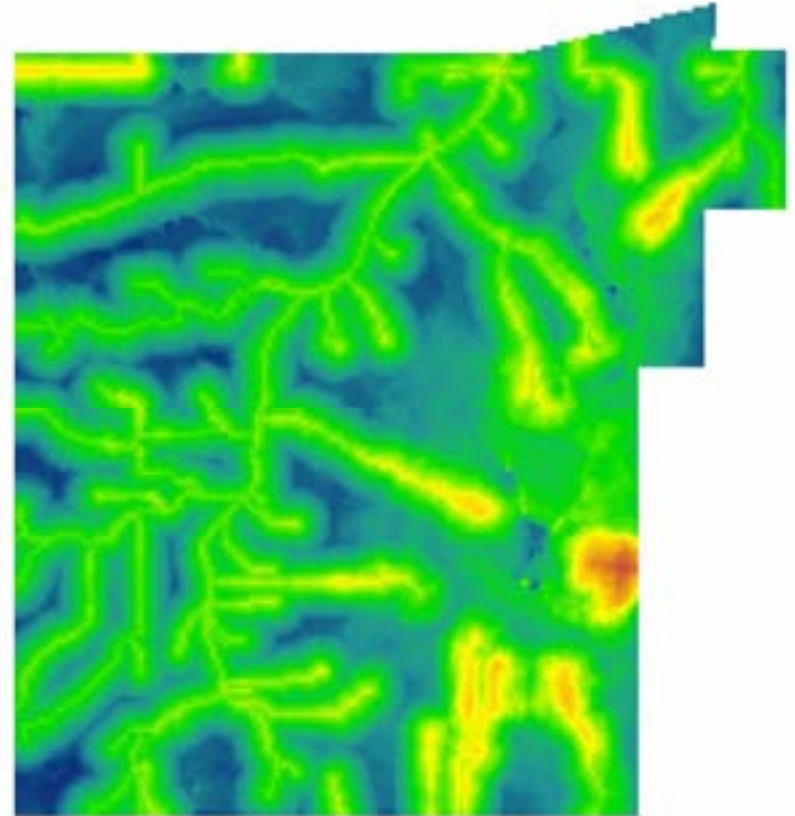
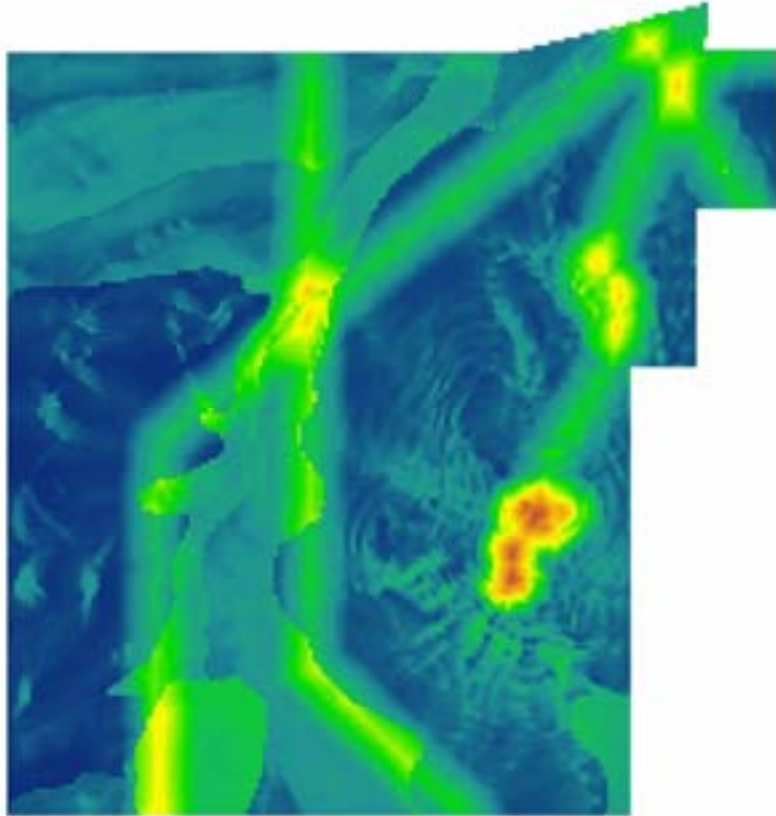
Aaryn Olsson, George Frisvold, Julio Betancourt, Travis Bean, Stuart Marsh and I are working on a USDA-ERS PREISM grant proposal to create a decision support system for buffelgrass in Pima County. The aim of the project is to first integrate social and physical factors (i.e., risk and values at risk) as well cross-organizational resources and restrictions. Our hope is the result will be a decision support tool that can help us bring mapping and documentation more realistically in cross-jurisdictional decision making and mitigation efforts.





# Decision support

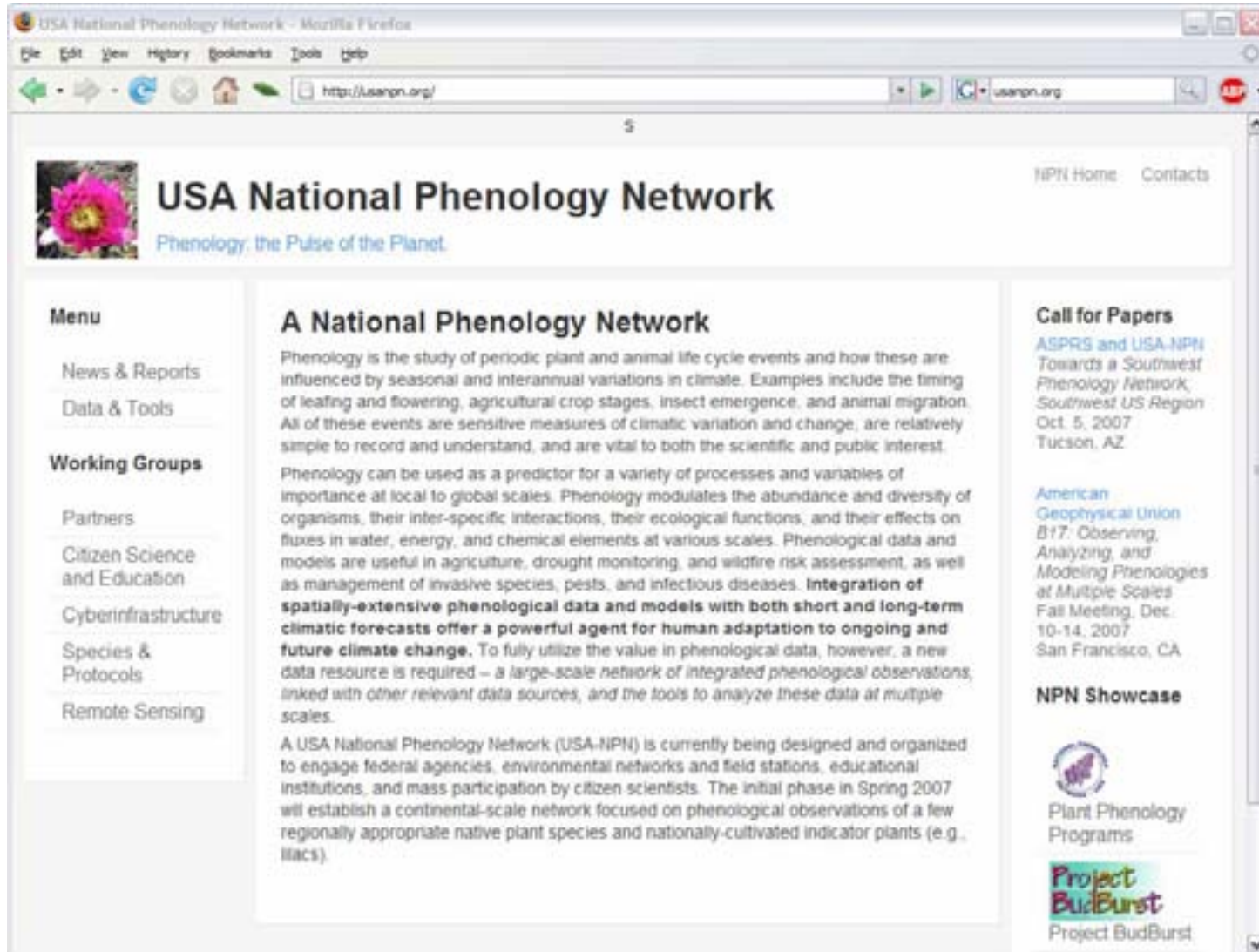
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Trial run of a buffelgrass decision support system using Tumamoc Hill data. On the left, infrastructure is given higher consideration. On the right, the ability to view saguaro is given higher consideration.

# Leverage synergistic activities

The National Phenology Network  
<http://usanpn.org/>



The screenshot shows the USA National Phenology Network website. The browser window title is "USA National Phenology Network - Mozilla Firefox". The address bar shows "http://usanpn.org/". The website features a header with a pink flower image and the text "USA National Phenology Network" and "Phenology: the Pulse of the Planet". A navigation menu on the left includes "News & Reports", "Data & Tools", "Working Groups", "Partners", "Citizen Science and Education", "Cyberinfrastructure", "Species & Protocols", and "Remote Sensing". The main content area is titled "A National Phenology Network" and contains a detailed description of phenology and the network's goals. The right sidebar includes a "Call for Papers" section for ASPRS and USA-NPN, an "American Geophysical Union" meeting announcement, and an "NPN Showcase" section featuring "Plant Phenology Programs" and "Project BudBurst".

USA National Phenology Network - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://usanpn.org/

USA National Phenology Network

Phenology: the Pulse of the Planet

NPN Home Contacts

Menu

- News & Reports
- Data & Tools

Working Groups

- Partners
- Citizen Science and Education
- Cyberinfrastructure
- Species & Protocols
- Remote Sensing

### A National Phenology Network

Phenology is the study of periodic plant and animal life cycle events and how these are influenced by seasonal and interannual variations in climate. Examples include the timing of leafing and flowering, agricultural crop stages, insect emergence, and animal migration. All of these events are sensitive measures of climatic variation and change, are relatively simple to record and understand, and are vital to both the scientific and public interest.

Phenology can be used as a predictor for a variety of processes and variables of importance at local to global scales. Phenology modulates the abundance and diversity of organisms, their inter-specific interactions, their ecological functions, and their effects on fluxes in water, energy, and chemical elements at various scales. Phenological data and models are useful in agriculture, drought monitoring, and wildfire risk assessment, as well as management of invasive species, pests, and infectious diseases. **Integration of spatially-extensive phenological data and models with both short and long-term climatic forecasts offer a powerful agent for human adaptation to ongoing and future climate change.** To fully utilize the value in phenological data, however, a new data resource is required – a large-scale network of integrated phenological observations, linked with other relevant data sources, and the tools to analyze these data at multiple scales.

A USA National Phenology Network (USA-NPN) is currently being designed and organized to engage federal agencies, environmental networks and field stations, educational institutions, and mass participation by citizen scientists. The initial phase in Spring 2007 will establish a continental-scale network focused on phenological observations of a few regionally appropriate native plant species and nationally-cultivated indicator plants (e.g., lilacs).

### Call for Papers

ASPRS and USA-NPN  
Towards a Southwest Phenology Network,  
Southwest US Region  
Oct. 5, 2007  
Tucson, AZ

American Geophysical Union  
B17: Observing, Analyzing, and Modeling Phenologies at Multiple Scales  
Fall Meeting, Dec. 10-14, 2007  
San Francisco, CA

### NPN Showcase

Plant Phenology Programs

Project BudBurst

# Citizens science







Thomas Litson,  
Grazing Committee Chair,  
Tsaile-Wheatfields Chapter,  
Navajo Nation

Laura Baker,  
NASA Space Grant  
Undergraduate Intern

**Thank You!**

**Barron J. Orr**

**Tani A. Hubbard**